

## TTGO LoRA Soundkit – Test of acoustical characteristics

This document describes the tests and results of the TTGO LORa Soundkit, an easy to build and low cost (ca. 35 euro) citizen sound sensor, see

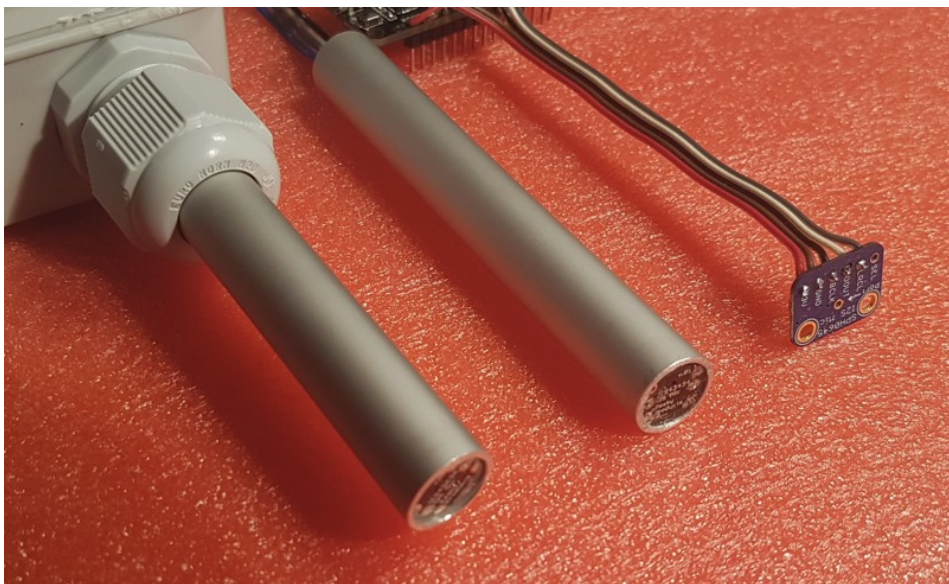
<https://github.com/meekm/LoRaSoundkit/tree/master/src/lorasoundkit>

We test 2 TTGO LoRa soundkits, one is equipped with SPH0645 MEMS microphone, the other is equipped with the ICS-43434 MEMS microphone.

In this test we also test the DNMS Teensy 4.0, a soundkit of Sensor.Community Germany see <https://sensor.community/en/sensors/dnms/>

### Devices to be tested are:

TTGO1:	TTGO Soundkit with ICS-43434
TTGO2:	TTGO Soundkit with SPH0645
DNMS:	DNMS Teensy 4.0 sensor.community with ICS-43434



The microphones ICS-43434 are assembled in a half inch tube with resin, as advised by Sensor.Community (in picture left and middle)

The SPH0645 is tested in open air (in picture right).

### Used test equipment

Sound calibrator:	Cirrus Research CR.515 (Certified class 1)
Soundlevel meter:	Embedded Acoustics SM90 (Certified class 1)
Audio amplifier:	Denon PMA 1500AE
Audio speakers:	Bower and Wilkins
Noise generator:	Audicity
Data registration:	InfluxDb and Grafana

Test are executed at 1-11-2021 by Peter Eilander (milieu geluid) and Marcel Meek (IoT Apeldoorn)

## The following tests are executed

- 1) calibrator test 1000hz 94dB
- 2) silence test( residual noise)
- 3) White, Pink and Brown Noise

### 1. Test results Calibrator class 1

Input	SM90	TTGO1	TTGO2	DNMS
1000Hz, 94dB	94.00	93.10	*) not tested	93.88

\*) the size of the SPH0645 Microphone is too large to fit in the half inch calibrator.

### 2. Test results Residual noise

Input	SM90	TTGO1	TTGO2	DNMS
Silence dB(a)	19.6	29.2	29.2	27.0

### 3. Test results white, pink and brown Noise

Input	SM90	TTGO1	TTGO2	DNMS
White noise	59.27	61.66	59.45	60.27
Pink Noise	53.90	54.28	54.07	54.96
Brown Noise	52.54	52.50	52.97	52.77

Deviation with SM90	TTGO1	TTGO2	DNMS
White noise	2.39	0.18	1.00
Pink Noise	0.38	0.17	1.06
Brown Noise	0.04	0.43	0.23
Average deviation	0.94	0.26	0.76

### 4. End Result and Conclusion

The DNMS has a good absolute SPL amplitude range and a slightly better residual noise level. However the frequency range of TTGO with the SPH0645 gives a better frequency response .

For a better impression of frequency response of the microphones, we should plan an extra sweep test. This will be added to this report in the future.

The measurement results of the TTGO with SPH0645 microphone are all within 1 dB deviation.

In our opinion, all 3 test sets meet the requirements in noisy environments, and are very suitable for measurements by citizens. For very low levels  $< 30\text{dB}$ , the MEMS noise may influence the result.

Taking the price/quality ratio into account the TTGO soundkit is good choice.